Conservation of Avian Genetic Resources: Current Opportunities and Challenges—A Summary[1]

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ABSTRACT Presented is an overview of the thesis of this symposium with a snapshot summation of the papers presented, including modest critiques and suggestions for future efforts.

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INTRODUCTION

Organizers of this symposium brought together experts from academe and industry to address historical and contemporary aspects of genetic conservation of avian genetic stocks. Although other species were mentioned, emphasis was on poultry and, more specifically, the chicken. Although we write "the chicken," throughout the symposium, it was very evident that "a chicken is not a chicken is not a chicken" and that describing and maintaining genetic diversity is paramount to conservation of genetic resources. Kennedy (2005) wrote "research is about answers, but science is about questions." A plethora of science and research was presented at this symposium. The papers published in this issue of *Poultry Science* are essential reading not only for poultry scientists, but for all individuals interested in conservation of genetic resources. Although we study the genetics of an individual and of populations, for the discipline of genetics to progress, there is need for information on genotypes and phenotypes. This information is essential because genotype-phenotype relationships are analogous to the wheels of a cart. One wheel by itself cannot precede a cart. The euphoria over sequencing the chicken genome and opportunities afforded for further understanding its evolution and inheritance is dampened by realization of the erosion of genetic stocks. Throughout the symposium, this bleeding was emphasized repeatedly.

Simplistically, genetics may be viewed as a discipline concerned with differences. Over the course of the symposium, however, complexities of issues for the real world of conserving differences became vivid. Conservation of genetic resources is multidisciplinary, not only in a biological context, but also politically, economically, and morally. What are criteria for conserving a population? What is the value of a population to research, science in general, poultry science in particular, medicine, and society? Should characterization be genotypic, phenotypic, or both? What are the costs in dollars, facilities, and/or personnel? What is known from research per se and is there the arrogance of "my opinion means more than your facts." Is it appropriate to ask for justification and need for conserving avian genetic resources? This symposium provided a resounding "yes," both to justification and need. Read the papers and view this summary as a brief overview. The details are in the papers.

THE PRESENTATIONS

Muquarrab Qureshi opened the symposium with a few brief remarks and then introduced John Hodges, who provided historical and contemporary overviews of global issues related to genetic conservation of farm animals. Domestication, which commenced during the Neolithic period, is a continuing process with a changing dynamic between humans and domestic animals. This dynamic continues to evolve among different cultures and societies. Hodges questioned whether what we are doing today is sustainable and, if not, asked whether we are approaching crises that may differ in rural and industrial societies. If we do not address these issues, is it cogent to ask not only of avian species but if our humanity is at risk? John's thought-provoking presentation set a standard for what followed.

Overviews not only of conservation programs in the US and Europe but where these programs fit globally

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were provided by Harvey Blackburn and Henri Woelders, respectively. It is frightening to realize that in the United States, 54% of poultry research populations are at 6 locations. Not only is cryopreservation of avian semen with glycerol a mechanical issue, but semen preservation per se ignores maternal contributions. Poultry in the United States and Europe may be classified as populations bred and maintained by fanciers, research institutions, and commercial breeders. In Europe, there are local breeds for niche markets that are comparable with heritage stocks in the US. Readers are referred to specific papers by Henri and Harvey for more information on preservation and inventories of avian stocks.

The high and low points in careers of an academic (Mary Delany) and an industrial (Janet Fulton) researcher were enlightening and informative and provided important lessons for both the younger and older members of the audience. Fulton was candid in stating what is and is not realistic and feasible in the industrial world of poultry breeding. Delany provided excellent background on resource populations and was insightful concerning long-term support for development and maintenance of experimental and mutant populations. Without such support at USDA and Land-Grant facilities, the research presented by Marcia Miller and Pat Johnson would not have been possible. Both Miller and Johnson demonstrated that the chicken is an excellent model for studies on disease resistance and predisposition for ovarian cancer.

Techniques with varying degrees of promise in preservation and reconstitution of avian populations were critiqued in 3 presentations. Julie Long lucidly pointed out biological differences in avian and mammalian reproductive organs. She then addressed the challenges they presented to avian reproductive physiologists per semen storage and subsequent fertilization. Jim Petitte provided an insightful critique of the potential for primordial, embryonic, and blastodermic cells for conservation of germplasm. Lastly, Stan Leibo demonstrated his expertise in cryobiology and pointed out that the ultimate assay is an adult that reproduces.

Lastly, Mary Hogedorn and Robert Taft shared their experiences in describing species preservation programs at the Smithsonian and stock maintenance at the Jackson Laboratory, respectively. Hogedorn provided an excellent example of the formation and disappearance of coral reefs as well as lessons on reproduction of fish, elephants, and pandas. Taft not only shared the workings of the Jackson Laboratory, he addressed a range of issues largely ignored by previous speakers, such as intellectual property rights.

The papers presented at this symposium were more than intellectually informative. We are at a critical stage in conservation of poultry, specifically, and avian species, in general. Several speakers provided insights into the long history of poultry, not just as a source of food, but also as models for studying biological systems. The papers presented in this symposium are not a conclusion; rather, they raise numerous issues and questions not only for the scientific community and for society as a whole. So, what is next?

WHAT NEXT?

It is a given that conservation of avian species, in general, and poultry, in particular, should be addressed with more than words. The value for poultry as food and as model experimental animals is well documented. Food categorization can include scavenger populations, entities of local breeds for niche markets, and multinational breeding organizations. That this later group has assumed a major role in food production is not an issue of right or wrong, but of reality. These breeding organizations work with large populations, which in turn allows for "new" variation via mutations and through plasticity from networks of pleiotropic genes.

In Europe, more so than in the United States, as well as in China, is the development of niche markets for local breeds. An expansion of this effort can be positive in maintaining populations that may face extinction. Yet, for this effort to occur, it must be successful economically. Scavenger populations are common in rural settings whereas fanciers exist throughout the globe.

Preservation may be viewed in the context of maintaining live populations and storage of germplasm. The former can be costly, and the latter is very much in the developmental stage. At risk in both cases is when maintenance of live stocks and storage of germplasm are at a single location. Preservation of germplasm, while essential in the case of subsequent needs, is itself a study area. Live populations provide an immediate resource for current and future research. Using the chicken as an example, determining what breeds, mutants, experimental lines, etc. should be maintained live is one issue, and what to preserve is another. Preservation of avian germplasm is in its infancy, and semen preservation is only one-half of the paradigm. The other half is ignored and consists of contributions by the females. As a side note, it was noted that ratio for paper presentations at this symposium was 50:50, male:female.

An important issue to address is who pays for the conservation of these genetic resources. The multinational food industry has a profit motive that hopefully is consistent with societal needs. That said, the implication is that conservation of avian species is a public issue. The Jackson Laboratory may be an example of a program relevant to a research community where the mouse is the experimental model. Although appealing, such would only be a component for the avian community because poultry, per se, and the chicken, in particular, are both model organisms and sources of food that include more than industrial production. Regardless of whether conservation is viewed in the context of genes, breeds, experimental lines, mutants, etc., conservation is relevant to a public that is engaged with societal issues. Therefore, mechanisms for public (i.e., government) support should be expanded with sustained funding to relevant federal and university facilities. The focus of existing and future units should

go beyond maintenance; they should involve scientific and research functions including the training of students. Although some of the papers presented in this symposium provided a current inventory, further development of this thesis is essential to halt the erosion of these genetic resources. This development requires increased and continuous support in the United States of existing programs, such as the National Animal Germplasm Program of the ARS-USDA, per se, and its Poultry Species Committee, the Chicken Model Organism Database, and universities currently maintaining unique populations. Conservation has global connotations, and further involvement of the Food and Agriculture Organization of the United Nations (FAO) is a given. This symposium should be viewed as a beginning not an end.

REFERENCES

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